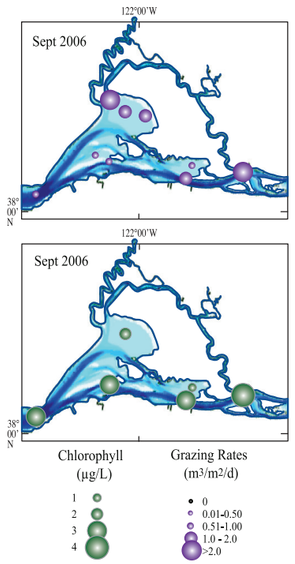
Corbula amurensis Distribution and Biomass Response to Hydrology and Food: A Model for CASCaDE Scenarios of Change

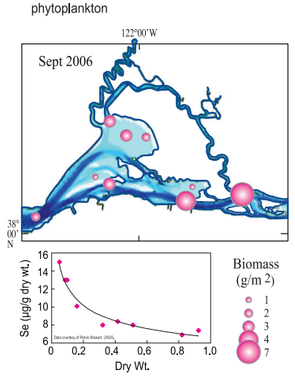
by Janet Thompson and Francis Parchaso

Why Do This?

Corbula is an efficient phytoplankton consumer and is a vector for contaminant transfer up the food web. Therefore, the *Corbula* model is an important link within the framework of CASCADE.



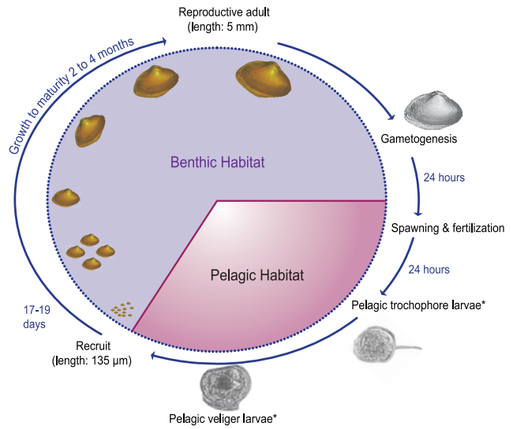
The inverse *Corbula* – phytoplankton distributions reflect top-down control of phytoplankton



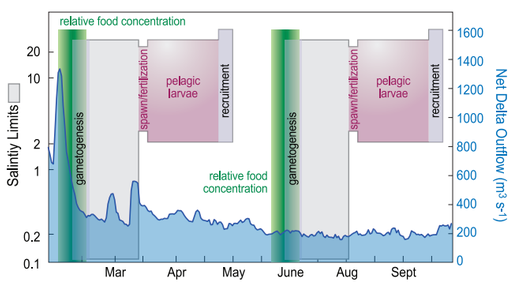
Contaminant transfer potential is a function of total clam biomass and population size structure.

Life Cycle of *Corbula amurensis*

Reproduction is triggered by food availability. Salinity of ≥ 2 is needed for most reproductive processes and larval success.



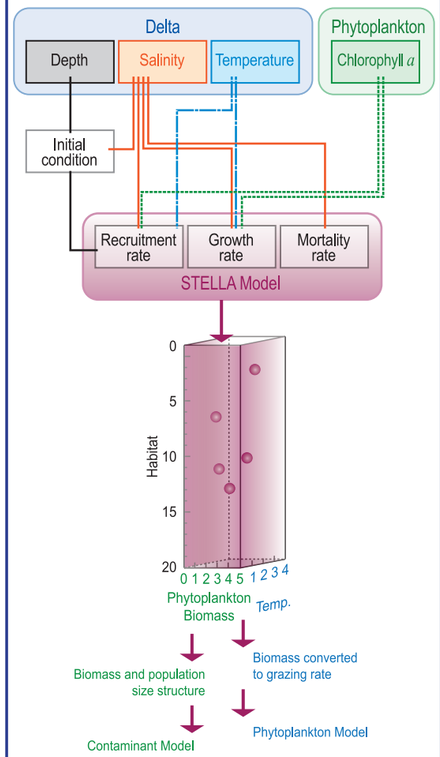
Environmental Controls on Reproduction



*From Nicolini, MH and DL Penry, 2000.

Population Model Input and Output

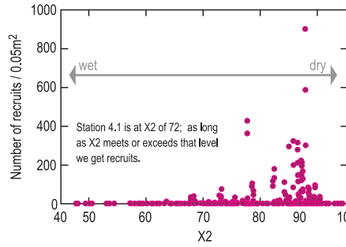
- *Corbula* biomass, growth rate and population structure are determined in STELLA.
- Environmental controls on initial conditions and population parameters are based on output from the Watershed and Delta models.
- STELLA output is stored in a 3D lookup table for use by the Phytoplankton and Contaminants models.



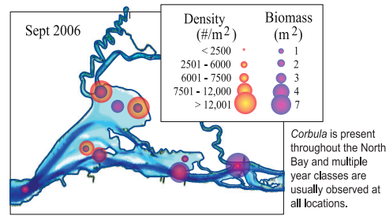
California Department of Water Resources, Environmental Monitoring Program kindly allowed us to use biomass and recruitment data from Station D7. This work was conducted as part of "CASCaDE: Computational Assessments of Scenarios of Change for the Delta Ecosystem" and "Analysis of archived samples to assess patterns of historic invasive bivalve biomass" both supported by grants from the CALFED Science Program, USGS Priority Ecosystems Science and the USGS Toxics Program. Thanks to Jeanne DiLeo for illustrations and poster design.

Initial Condition

Abundance and distribution at t_0



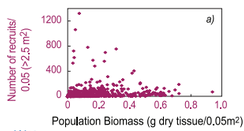
Distribution into the Delta is limited by salinity. Recruit abundance within X2 decreases as X2 migrates down bay. Data is from USGS Sta 4.1 at Chipps Island.

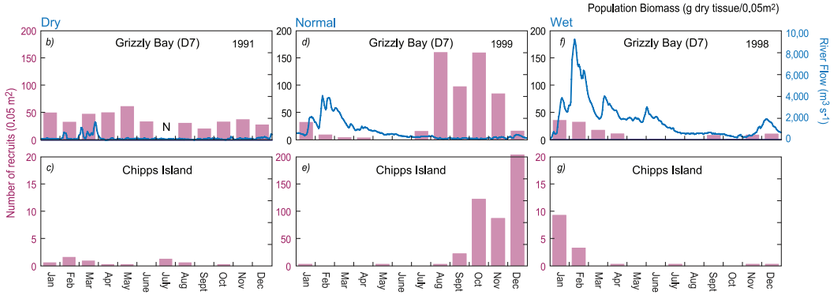


Corbula is present throughout the North Bay and multiple year classes are usually observed at all locations.

The Model Parameters

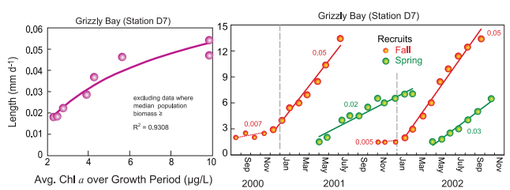
Recruitment Rate





(*a*) Recruits have limited success in areas with large populations of adult *Corbula*. Recruitment rate and season can be predicted based on the biomass of the adult population and the hydrologic year in each habitat. (*b, c*) Reproduction (but not necessarily recruitment) occurs twice in most years in the North Bay. Recruitment was low and appeared to be continuous during the drought but many of these recruits were from the previous recruitment and did not significantly increase shell length. (*d, e*) In normal hydrologic years, recruitment occurs when salinity increases to >2 in summer and fall. (*f, g*) Recruits seen during the winter of wet years are recruits from the previous fall. Recruitment in summer and fall occurs only when salinity drops to <2.

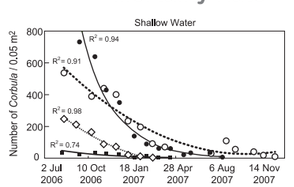
Growth Rate



Growth rate depends on phytoplankton and may be limited when chlorophyll *a* is < 10µg/L.

Available food and a large biomass limit growth in fall. Recruits that settle in fall begin growing before the spring recruits arrive, and grow faster and larger than spring recruits.

Mortality Rate



Mortality is density dependent for the young. Shallow water populations drop significantly during late fall and winter due to bird predation.

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